

also rejected under 35 U.S.C. §103 (a) as being unpatentable over U.S. Patent No. 5,519,496 to Borgert et al. in view of U.S. Patent No. 5,420,773 to Huang.

Brief Summary of the Amendment

Claims 1 and 2 have been canceled. Claim 3 has been added and is currently the only pending claim. Reconsideration of the application as amended is requested.

Objection to the Specification

A substitute specification in proper idiomatic English has been required. Applicant has prepared and filed a substitute specification with this response. A marked up copy of the original specification has also been provided. No new matter has been added.

Rejections Under 35 U.S.C. §112

Claims 1 and 2 have been rejected under 35 U.S.C. § 112, second paragraph, as being indefinite. Specifically, no antecedent basis was found for the phrase “the side” of the concave face on line 11 of claim 1. In view of the cancellation of claim 1, this rejection is now moot. Claim 3 does not include the objected to phrase. Instead, it recites “a side” of the concave face. As a result, it is submitted that claim 3 is definite. For the above discussed reasons, the rejection 35 U.S.C. § 112, second paragraph, should be withdrawn.

Rejections Based on Prior Art

The Present Invention

Lighting units have been used to illuminate a surface of a product in order to detect micro flaws and finishing defects. The lighting units typically include an underside carrying a plurality of light-emitting diodes that light up the surface being examined. However, the assembly of these lighting units include complicated and costly steps that make the manufacturing of the units a difficult and time consuming production. These complicated and costly steps include

processing the underside of the lighting unit so that it takes on the shape of a hollow truncated cone, perforating a plurality of holes on the resulting concave underside face, embedding a diode in each of the holes and individually wiring each of the diodes by hand. Moreover, the steps of processing the underside of the lighting unit and creating the angle of the hole perforation vary so much between conventional lighting units having different angles for emitting light that it is difficult to standardize a process for forming them.

The present invention relates to a method of manufacturing a lighting unit for inspecting a surface. The lighting unit has an opening at its center for visually inspecting or taking photos of the surface being inspected. The method includes the steps of holding a flexible circular printed circuit board having a concentric circular hole and a cutout which has at least two sides in a planar state and embedding a plurality of illuminants in the printed circuit board. The method also includes jointing one side of the cutout and the other side of the cutout of the printed circuit board or holding both sides in close contact so as to form the printed circuit board into a shape of a hollow truncated cone with the illuminants placed in a side of a concave face of the printed circuit board. The method further includes the step of retaining the circuit board in the shape of a hollow truncated cone using a frame so as to obtain the lighting unit in which a plurality of illuminants are arranged on the concave face of the printed circuit board formed into the shape of a hollow truncated cone.

Unlike the prior art methods of forming a lighting unit, the present invention includes a frame that makes it easy to change the lighting unit's angle of emittance in order to easily accommodate the product being illuminated. The frame makes it possible to easily change the angle of emitting light by modifying only one part of the lighting unit. For example, the angle can be adjusted by changing the diameter of the printed circuit board or the size of the cutout.

Since the angle of emittance can be adjusted by changing only one part of the lighting unit, it is easy to manufacture a variety of lighting units with various light emitting angles that properly illuminate different products.

Rejection under § 103

Claims 1 and 2 have been rejected under 35 U.S.C. §103 (a) as being unpatentable over U.S. Patent No. 5,519,496 to Borgert et al. in view of U.S. Patent No. 5,420,773 to Huang. Borgert discloses an inspection systems for detecting flaws in an object. This system includes an illumination system for generating an image of the object being inspected. The illumination system includes a lighting dome, a vertical light source, an image acquisition means, a light controlling means, a system controller and a three-axis servo system. These components of the illumination system work together to capture an image of a preselected area of an object being inspected. The lighting dome is formed of a unitary circuit board with a plurality of surface mounted light emitting diodes. The dome has a plurality of sections connected together by hinges. Each section includes an upper and lower portion which define illumination banks for illuminating a product from 360 degrees around the object.

Even though Borgert does not teach a method for manufacturing the lighting dome, it is relied upon in the Office Action for teaching all of the claimed method except for the step of forming the printed circuit board into the shape of a truncated cone. However, Borgert also fails to teach the steps of : (1) holding a flexible circular printed circuit board having a cutout with at least two sides in a planar state; (2) jointing these two sides of the cutout together or holding them in close contact so that a hollow truncated cone is formed; and (3) retaining the circuit board in the shape of a hollow truncated cone within a frame. Borgert cannot disclose these steps for it does not discuss or contemplate using a printed circuit board having a cutout with at

least two sides in planar state or a frame for retaining the circuit board in the shape of a truncated cone.

Unlike the present invention and Borgert, Huang does not relate to a lighting unit for illuminating the surface of a product in order to inspect for surface flaws or defects.

Additionally, Huang does not include a circuit board with a plurality of embedded illuminants that evenly light up the surface of the product being inspected. Instead, Huang discloses a lamp shade for a table lamp that softens the light given off by a bulb. The lamp shade includes a plurality of pieces jointed together for easy breakdown when the lamp is being transported or stored.

The Office Action relies upon the disclosure in Huang that the shade has a plurality of pieces secured together in the shape of a truncated, conical structure. The Office Action suggests that modifying the lighting dome of Borgert with the lamp shade of Huang would have been obvious for the purpose of reducing the costs and complexity of forming the lighting dome.

One of ordinary skill in the art would not have been motivated to modify the method of manufacturing the illuminating dome of Borgert with the lamp shade of Huang. The lighting dome of Borgert is intended to fully and evenly illuminate a product being inspected. Whereas, the lamp shade of Huang is used as decoration and to soften the light emitted by its lamp. These references disclose devices that are completely unrelated to each other. There is no suggestion in Huang that the lamp shade could be used with a device for evenly distributing light on the surface of a product. Instead, Huang teaches the opposite - that the lamp shade is intended to soften the light emitted by the lamp. Moreover, the lamp shade could not house a plurality of illuminants on its inner surface and still function as intended. Therefore, it is submitted that one of ordinary skill in the art would not have looked to decorative lamp shades that soften light in

order to modify a method of manufacturing a lighting dome that evenly lights the surface of a product during product inspection.

Nevertheless, even if motivation existed to modify Borgert with Huang as suggested in the Office Action, the resulting combination would not arrive at the claimed invention. Neither Borgert nor Huang contemplates using a frame to keep the printed circuit board in the shape of a hollow truncated cone so the illuminants are properly positioned for lighting a product during surface inspection. Moreover, neither reference discloses at least the method steps of: (1) jointing the sides of a cutout in the printed circuit board or holding these sides in close contact so as to form the shape of a hollow truncated cone; and (2) retaining the printed circuit board in the shape of the hollow truncated cone within a frame. Therefore, the rejection should be withdrawn.

Conclusion

For the reasons discussed above, applicant submits that claim 3 is in condition for allowance. A notice to this effect is earnestly solicited. If the examiner has any questions, it is requested that he phone the undersigned at (202) 508-9100. No fees are believed needed.

However, in the event that any fees for filing this amendment are required, please charge them to Deposit Account No. 19-0733.

BANNER & WITCOFF, LTD.
1001 G Street, N.W. - 11th Floor
Washington, D.C. 20001
Telephone: 202-508-9100
Dated: August 4, 1999

Respectfully submitted,

By: Brian E. Hanlon
Brian E. Hanlon
Registration No. 40,449